BIO-MULCH: AN EFFECTIVE TOOL OF WEED SUPRESSION IN ALLEY CROPPING

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Abstract

In alley cropping systems mechanical weed management might face obstacles within the tree rows. The aim of the experiment carried out within the frame of the AGFORWARD project in a silvoarable agroforestry system with timber trees (*Paulownia* sp.) intercropped with alfalfa was to test if raw biomass mulch can be used for weed suppression purposes in a technically and economically successful way. Based on the results, mulching with locally available fresh biomass can be effectively used for weed control purposes and provides additional advantages such as the improvement of soil fertility, microclimate and water management.

Keywords: alley cropping; weeds; silvoarable

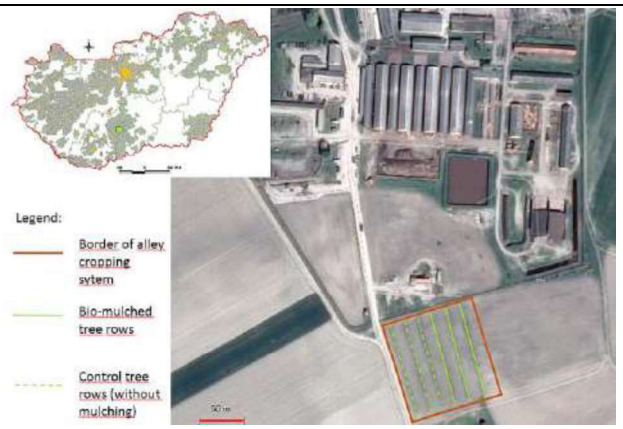
Introduction

In alley cropping systems mechanical weed management might face obstacles within the tree rows (because of the lack of space, presence of cultivated plants, etc.), and as a consequence, unit labour cost of weed control is often higher than in monocultures. Use of herbicides is not recommended, due to potential damage to the trees. Straw cover is a possible method of weed control, but its effectiveness depends on local circumstances (e.g. not effective in windy areas), and its removal is required during winter as it attracts rodents. The experiment was carried out within the frame of AGFORWARD project, in a silvoarable agroforestry system with timber trees (*Paulownia* sp.) intercropped with alfalfa (Vityi et al. 2015). The aim was to test if raw biomass mulch can be used for weed suppression purposes in a technically successful and economically viable way.

Materials and methods

Herbaceous flora of the tree rows and a part of the first harvest of the crop (*Medicago sativa*) were used to mulch the tree rows (note, it is important to harvest weeds before flowering, otherwise mulching will lead to the spread of weeds within the tree rows). The use of bio-mulch was tested in three of the six tree rows planted in the experimental agroforestry system (see map in Table 1). Tree rows with motormanual weed control were the control. Herbaceous cover was made in early May 2016 and 2017 in order to test effectiveness during the most intensive growing period of the year. Weeds were cut using a motor-manual method, while alfalfa was harvested mechanically and spread manually in the tree rows. The thickness of bio-mulch layer is crucial. In the experiment the thickness of biomass cover was 10 cm and material harvested closest to tree rows was used due to economic reasons. The recorded parameters were: i) weed percentage cover (from May to July 2016 and 2017), ii) labour time and costs of covering the surface for weed control and iii) annual growth of trees in mulched rows and the control rows without bio-mulch (based on measurements carried out at the end of growing seasons of 2015, 2016, and 2017).

Table 1: Description of the experimental site.

Area	2 ha
Co-ordinates	46°40'51.41"N, 18°92'71.98"E
 	
Map of system	
Mean monthly temperature	12.5 °C
Mean annual precipitation	429.2 mm
Soil type	WRB classification: Phaenozem
Soil texture	Clay loam
Additional soil characteristics	Plasticity according to Arany (K_A): 52; Humus content 3.6%; Groundwater 3.8-4.4 m below soil surface. Topsoil: loam/clay loam; subsoil: clay loam or clay with gleyic colour pattern (stagnic gley)
Aspect	North-West/South East
Tree species	*Paulownia tomentosa (var. CE.), number of trees: 126*
Date of tree planting	2013
Intra-row spacing	14 m
Inter-row spacing	5 m
Crop species	*Triticale* (*Medicago sativa*)
Crop management	Fertilization once per year, harvest 4-5 times per year No herbicides applied
Crop products	Fodder

Results

The bio-mulch effectively suppressed weeds for approx. 60 days and resulted in a reduction of two weed-cutting periods during the growing season. By the end of the second month, the

percentage of weed cover in treated rows was 25% less than the non-covered rows. Also the number of weed species and their density decreased significantly (Figure 1).

Figure 1: Change of weed pattern in tree rows in relation to time (1: 3rd week, 2: 5th week, 3: 8th week) and control rows without bio-mulching (4) (Photo: Péter Schettrer).

The results of tree development show a significant difference in diameter growth for rows covered with bio-mulch (alfalfa and weed), compared to non-covered rows ($t<0.05$; $p=0.048835$). As trees were managed equally, the difference may be attributable to the effect of the different weed management (Figure 2).

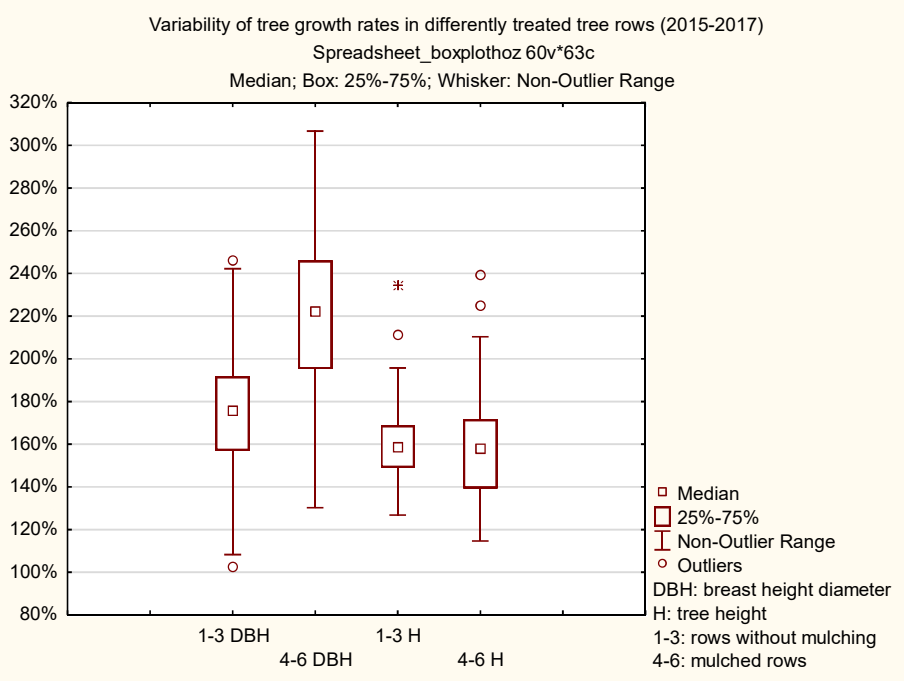


Figure 2: Effect of bio-mulching on tree growth rates in growing seasons 2016 and 2017

Evaluation of the test results and conclusion

Based on the results, mulching with locally available fresh biomass can be effectively used for weed control purposes. Furthermore, improved water use efficiency may be improved due to a reduction in soil evaporation within the tree rows. The key advantages of the method are improvement of soil fertility, microclimate and water management. Besides, this practice is environment-friendly and thus applicable in organic production systems as well.

Acknowledgement

The authors would like to thank the forestry company who participated in this transdisciplinary exercise. We acknowledge the support of the European Commission through the AGFORWARD FP7 (contract 613520) and AFINET H2020 (contract 727872) research projects.

References

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